

# Stat 140 Binomial Example

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## Binomial example (adapted from SDM4 16.41)

An orchard owner knows that he will have to use about 6% of the apples he harvests for cider because they will have bruises or blemishes. He expects a tree to produce about 300 apples.

(a) Is a binomial model appropriate? 3 assumptions to check:

- 1) 2 outcomes: each apple is either a cider apple or not.
  - 2) same probability of success on all trials: seems reasonable to assume the apples on the tree all have an equal probability of being bruised
  - 3) independence: since our 300 apples are on the same tree, it seems likely that whether they are bruised is not independent. For example, all apples on a tree may be damaged in a storm. An assumption of independence does not seem reasonable.
- A binomial model is not appropriate.

(b) If a binomial model were appropriate, what would the expected value and standard deviation of the number of cider apples on the tree be?

If a binomial model were appropriate we could define  
 $X =$  total number of cider apples out of the 300, and model  
 $X \sim \text{Binomial}(300, 0.06)$

The expected value of a binomial random variable is  $E(X) = n \cdot p$   
 $= 300 \cdot 0.06$   
 $= 18$

(c) Use R to calculate the probability that there will be no more than 12 cider apples.

The R command to use is

`pbinom(q=12, size=300, prob=0.06)`.

This calculates  $P(X \leq 12) = 0.085$